

### Remarks

Applicants acknowledge the Examiner's entry of the preliminary amendment to claims 1 and 9.

Claims 9-15 inclusive remain in this application.

Claims 1-8 inclusive have been canceled. Accordingly, the double patenting rejection in paragraphs 2-3 of the Office communication, and the Section 112 rejection in paragraphs 4-5 of the Office communication are not addressed in this amendment.

The Section 103(a) Rejection over US Patent App. No. 2003/0124390 A1 (Abarra et al.) in view of US Patent No. 6,794,057 B2 (Wang et al.)

All remaining claims 9-15 have been rejected under Section 103(a) as being unpatentable over US Patent App. No. 2003/0124390 A1 (Abarra et al.) in view of US Patent No. 6,794,057 B2 (Wang et al.) and in view of the evidence supplied by WO 03/065356 A1 (Do et al.). As an aside it is noted that the parent application to Abarra (App. No. 09/425,788) was the subject of an interference (Interference 105,156) with US 6,280,813 (issued to IBM and later assigned to the same assignee as this application), that an adverse judgment against Abarra was entered by the Board on 02/15/2005, and that an express notice of abandonment was filed in App. No. 09/425,788.

The Examiner notes that "essentially, Abarra et al. is teaching that the relative magnitude of the Mrt of the various layers is not critical to the invention, i.e. whether the second lower FM layer has a lower or higher Mrt than the first and lower FM layers are functional equivalents." Applicant's invention is based on precisely the *opposite* teaching, i.e., it is critical that the Mrt of the second lower FM layer (LL2) be less than the Mrt of each of the first and third lower FM layers (LL1 and LL3), and preferably as small as possible.

Abarra teaches nothing more than what is taught by US 6,280,813, cited in the background of the application (page 2, lines 3-13), namely that multiple antiparallel coupled layers can achieve a lower Mrt than a single layer without a reduction in total grain volume, and thus without a reduction in thermal stability of the medium. This is shown in Abarra's Fig. 1, wherein  $Mrt_{COMPOSITE} = Mrt(\text{layer 9}) - Mrt(\text{layer 7})$ , which is clearly less than  $Mrt(\text{layer 9})$ . However, Abarra does not teach the desirability of achieving as low a composite Mrt as possible to achieve a low value of PW50. This fact is established by

Abarra's second embodiment (Fig. 2) wherein a third layer (layer 7-1) is added, which must by necessity *increase* Mrt above the Mrt of the first embodiment because

$M_{RT,COMPOSITE} = [M_{RT}(layer\ 9) - M_{RT}(layer\ 7)] + M_{RT}(layer\ 7-1)$ . This shows that the "relative magnitude of the Mrt of the various layers is not critical" to the *Abarra invention*, i.e., using multiple antiparallel layers to reduce the Mrt below the Mrt of a single layer. However, the relative magnitudes of the Mrt of each of the layers in the four-layer structure of Applicants' invention *are critical to Applicants' invention*.

Because Abarra does not teach the desirability of achieving as low a composite Mrt as possible, Abarra can not teach or suggest the desirability of *maximizing the Mrt of the lower layer* (or layers) to reduce PW50, as explained in Applicants' application (page 2, lines 13-19). As a result, a "functionally equivalent" Abarra structure (e.g., LL2 having an Mrt *higher* than the Mrt of LL1 or LL3) would result in an *increase* in PW50, as clearly shown by Applicants' Fig. 4 for the case where the Mrt of LL2 is greater than 0.13 memu/cm<sup>2</sup> (the Mrt of LL1 and LL3). In contrast, in Applicants' invention a 5% *reduction* in PW50 is achieved when the Mrt of LL2 is less than the Mrt of each of LL1 and LL3, also as shown in Applicants' Fig. 4.

More importantly, Abarra does not teach or suggest the problem that arises when attempting to maximize Mrt of the lower layer (or layers), i.e., that the intrinsic media noise (measured by S<sub>0</sub>NR) becomes unacceptable, as described in Applicants' application (page 2, lines 20-27). Again, as shown by Applicants' Figs. 5A & 5B, the media S<sub>0</sub>NR can be increased above the S<sub>0</sub>NR of the reference AFC media *when the Mrt of LL2 is less than the Mrt of each of LL1 and LL3*. This critical requirement of relative Mrt values for the four layers in Applicants' invention results in maximizing the Mrt of the lower layer structure (LL1, LL2 and LL3), and thus minimizing Mrt<sub>COMPOSITE</sub>, to achieve low PW50, while also *increasing* media S<sub>0</sub>NR. Applicants submit that this is precisely the "unexpected results" which the Examiner has requested be presented.

Because Abarra teaches that the relative Mrt values of the lower layers are not critical, but functionally equivalent, it *teaches away* from Applicants' invention. Thus, one relying on Abarra would have no motivation to chose the relative Mrt values for the four layers in the four-layer structure claimed by Applicants.

Wang has been cited for teaching that the main recording layer (the one with the largest Mr<sub>t</sub> or Layer 1 in Wang's Fig. 3a) possesses an Mr<sub>t</sub> greater than the sum of the Mr<sub>t</sub>s of *multiple layers* with magnetizations antiparallel to the magnetization of the main recording layer. Wang's structure is intended to *reduce* Mr<sub>tCOMPOSITE</sub> below that of a conventional two-layer structure by adding a third layer *above* the main recording layer. However, Wang's structure is limited to a three-layer structure where the main recording layer (Layer 1) is the *middle of three layers* because the lowermost layer (Layer 2) and the uppermost layer (Layer 3) each has a magnetization antiparallel to the magnetization of Layer 1. The addition of a fourth layer, which would have a magnetization *parallel* to the magnetization of Layer 1, would by necessity *increase* Mr<sub>tCOMPOSITE</sub>. So, *unlike Applicants' invention*, Wang does not teach or suggest a way to *maximize* the Mr<sub>t</sub> of the multiple layers whose magnetizations are antiparallel to the magnetization of the main recording layer, and thereby a way to *minimize* Mr<sub>tCOMPOSITE</sub>. Moreover, Wang has been cited for combination with Abarra. However, the Section 103(a) rejection does not suggest how the unique three-layer Wang structure (with the middle layer as the main recording layer) could be combined with the Abarra structure to arrive at Applicants' four-layer structure with its critical Mr<sub>t</sub> relative values.

The Section 103(a) Rejection over US Patent App. No. 2005/0008902 A1 (Bertero et al.) in view of the evidence supplied by WO 03/065456 A1 (Do et al.)

Remaining claims 10 and 13-15 have been rejected under Section 103(a) as being unpatentable over US Patent App. No. 2005/0008902 A1 (Bertero et al.) in view of the evidence supplied by WO 03/065456 A1 (Do et al.).

Bertero is not in any way applicable to antiferromagnetically-coupled *recording media*. Instead, Bertero is directed to the well-known antiferromagnetically-coupled soft magnetic underlayer (often called a "SUL") for use *below* a *perpendicular* magnetic recording layer. This type of SUL has been previously described in U.S. Patents 6,686,070 B1 and 6,835,475 B2. The SUL is not used to store data, but to provide a flux return path for the applied write field from the perpendicular recording head (Bertero; para [0003]). The soft magnetic layers 331 that make up the SUL 315 do *not* have any significant remanent magnetization in the absence of an applied magnetic field, but become antiferromagnetically coupled in the presence of the applied field from the write head to improve the flux-return

properties of the SUL. However, to avoid any doubt Applicants have amended their independent claim 9 to recite that the AFC structure is a "magnetic recording layer" made up of the four ferromagnetic layers. In view of this amendment and the above discussion distinguishing a perpendicular magnetic recording layer with an AFC SUL from an AFC recording layer, Applicants believe that this Section 103(a) rejection is overcome.

In view of the above amendment and comments Applicants believe all remaining claims are in condition for allowance. The Examiner is invited to call Applicants' attorney if a telephone conference will expedite the prosecution of this application.

Respectfully submitted,

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